WHAT IS CLAMED IS:

1. A chemical substance detection sensor for use with a sample comprising:

two optical waveguides having different optical path lengths for dividing and transmitting light emitted and divided from a light source;

a reaction chamber for allowing a sample to flow through regions of said two optical waveguides wherein ligands are provided on at least one of said two optical waveguides;

an optical combiner for combining light outputs from said two optical waveguides; and

a detector for detecting a chemical substance contained in said sample by capturing the interference light output from said optical combiner, wherein

said sensor further comprises a wavelength-tuning device for adjusting the light wavelengths of said light source, wherein the optical path lengths of said two optical waveguides differ from each other by a 1/4 wavelength or more.

2. A chemical substance detection sensor according to claim 1, wherein

said wavelength-tuning device is a wavelength-tunable semiconductor laser.

3. A chemical substance detection sensor according to claim 1, wherein

said wavelength-tuning device is comprised of a converter for converting light wavelengths generated from a fixed-wavelength light source.

4. A chemical substance detection sensor according to claim 3, wherein

an acousto-optic device is installed between said light source and said two optical waveguides.

5. A chemical substance detection sensor as in claim 1

wherein said sensor includes a temperature controller for said reaction chamber, and the optical path lengths of said two optical waveguides differ from each other by 1/4 or more wavelength.

6. A chemical substance measuring apparatus for use with a sample comprising:

two optical waveguides having different path length for dividing and transmitting light emitted from a light source;

a reaction chamber for allowing a sample to flow through regions of said two optical waveguides wherein ligands are provided on at least one of said two optical waveguides;

an optical combiner/splitter for combining and redividing outputs from said two optical waveguides;

an output operation controller for measuring a chemical substance contained in said sample based on interference light output from said optical combiner/splitter;

a flow controller for controlling a flow of the sample into said reaction chamber;

a temperature controller for controlling the temperature in said reaction chamber; and

a measurement controller coupled to said output operation controller, for control of at least said flow controller and temperature controller, wherein

said apparatus further comprises a wavelength-tunable device for adjusting wavelengths of light of said light source, wherein the optical path lengths of said two optical waveguides differ from each other by 1/4 or more wavelength, and said wavelength-tunable device is configured to adjust the wavelengths of light of said light source so that the intensities of two interference outputs from said optical combiner/splitter are equalized when a

reference sample flows in said reaction chamber and said adjusted wavelength of said light source is maintained while a test sample flows in said reaction chamber.

7. A chemical substance measuring apparatus according to claim 6, wherein

said wavelength-tunable device for adjusting the light wavelengths of said light source comprises a wavelength-tunable semiconductor laser having a voltage control for said wavelength-tunable semiconductor laser.

8. A chemical substance measuring apparatus according to claim 6, wherein

said wavelength-tunable device for adjusting the light wavelengths of said light source is comprised of a fixed-wavelength light source and a wavelength conversion device for converting fixed wavelength output light of said light source.

9. A chemical substance measuring apparatus according to claim 8, wherein

a wavelength monitor device is installed on the output side of said wavelength-tunable device which adjusts fixed-wavelength output light of said light source, and which monitors changes in the light wavelength adjusted by

said wavelength-tunable device and which feeds the data on said light wavelength changes back to said measurement controller.

10. A chemical substance measuring apparatus according to claim 8, wherein

said wavelength converter device is a phase modulator possessing electro-optic effects wherein said apparatus further comprises a signal generator for applying a sinusoidal wave to said phase modulator, and also a filter for blocking unmodulated wavelength components of fixed-wavelength light from said light source installed between said phase modulator and said optical waveguides.

11. A chemical substance measuring apparatus as in claim 6 comprising:

wherein said light source is a fixed-wavelength light source, and the optical path lengths of said two optical waveguides differ from each other by 1/4 or more wavelengths, and said temperature controller and said measurement controller are configured to set a temperature at which the intensities of the two interference outputs from said optical combiner/splitter are equalized when the reference sample flows in said reaction chamber and also to maintain the temperature in said reaction chamber at said

temperature level while the sample under test flows in said reaction chamber.

12. A chemical substance measuring apparatus for use with a sample comprising:

at least one chemical substance detection sensor having a reaction chamber for the sample and optical waveguides having different path lengths running through the reaction chamber;

an output operation controller for measuring a chemical substance contained in the sample based on output of the chemical substance detection sensor;

a flow controller for controlling flow of the sample into said reaction chamber;

a temperature controller for controlling the temperature in said reaction chamber;

a measurement controller coupled to said output operation controller, for control of at least said flow controller and said temperature controller, wherein

said temperature controller, said flow controller, and said measurement controller are configured to set a temperature level at which the intensities of two interference outputs from an optical combiner/splitter are equalized when a reference sample flows in said reaction chamber and also to determine the operating point where the

temperature level is maintained in said reaction chamber while the sample under test flows in said reaction chamber.

13. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the ligands are antigens.

14. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the ligands are antibodies.

15. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the ligands are DNA.

16. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the ligands are RNA.

17. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the reaction chamber and the ligands are arranged to detect antigens.

18. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the reaction chamber and the ligands are arranged to detect antibodies.

19. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the reaction chamber and the ligands are arranged to detect DNA.

20. The chemical substance detection sensor for use with a sample of claim 1 wherein:

the reaction chamber and the ligands are arranged to detect RNA.